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CARGO/FIRE GROUP CHAIRMAN'S FACTUAL REPORT

by

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NATIONAL TRANSPORTATION SAFETY BOARD

Office of Research and Engineering
Washington, D.C. 20594

May 4, 2006

CARGO/FIRE GROUP FACTUAL REPORT

A. ACCIDENT

Accident Number: DCA06MA022
Operator: United Parcel Service Company
Location: Philadelphia International Airport (PHL), Philadelphia, PA
Date: February 7, 2006
Time: 2359 Eastern Standard Time (EST)
Airplane: DC-8-71F, N748UP

B. CARGO/FIRE GROUP

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C. SUMMARY

On February 7, 2006, at 2359 eastern standard time, a Douglas DC-8-71F, N748UP, operated by United Parcel Service Company (UPS) as flight 1307, landed at Philadelphia International Airport (PHL), Philadelphia, Pennsylvania, after the crew reported a cargo smoke indication. The three flight crewmembers were able to evacuate the airplane using the L1 slide. Fire subsequently caused substantial damage to the airplane and numerous cargo containers on board. The three crewmembers received minor injuries. Night visual meteorological conditions prevailed and an instrument flight rules flight plan had been filed for the flight from Hartsfield-Jackson Atlanta International Airport (ATL), Atlanta, Georgia, to PHL. The scheduled cargo flight was conducted under 14 CFR Part 121.

D. DETAILS OF THE INVESTIGATION

Examination of Wreckage

Exterior of Aircraft

There were two burn through holes in the crown of the fuselage. There were also two areas of partial burn through, one located in the crown and one located on the right side of the aircraft aft of the wing.



Figure 1: Overall of damage to crown.

On the exterior of the aircraft, the exterior paint was intact on most of the aircraft with the exception of the areas surrounding the two burn through holes in the crown where the paint was gone from the remaining structure. The paint was bubbled and darkened at the crown over the wings. There was sooting around the Crew Forward Entrance door, the four overwing exits and the Right Aft Service door. The paint around the outflow valve was heavily sooted and slightly bubbled. There was no other significant exterior damage on the aircraft.



Figure 2: Burn through holes in crown of the aircraft (facing forward).



Figure 3: Damage to exterior of aircraft (right side).

Interior of Aircraft

The forward part of the aircraft was heavily sooted. Up to Frame Station (FS) 702, there was no structural damage and the liners were still in place.

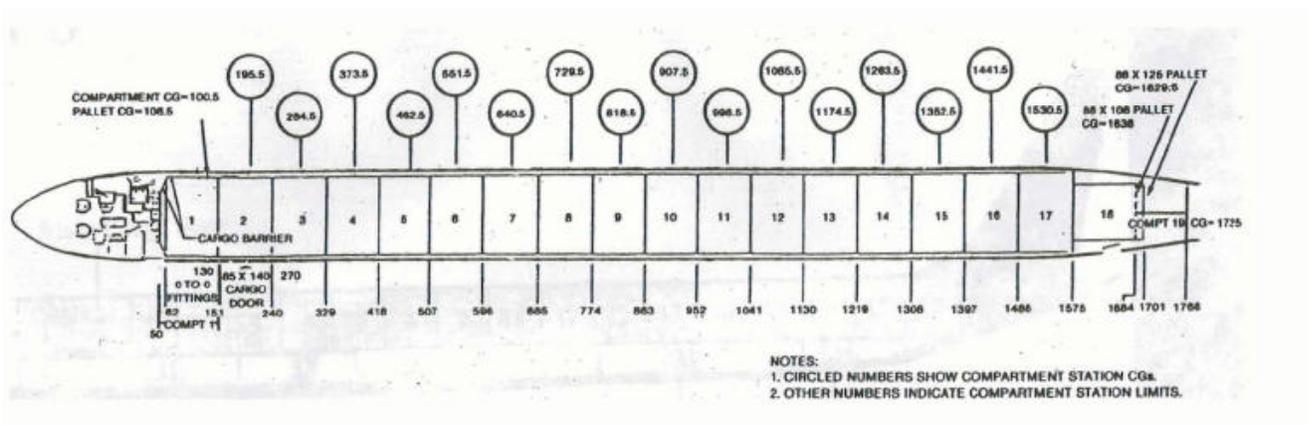


Figure 4: Diagram of Position Location and Frame Stations.

At FS 702.875, FS 717.750, FS 742.250, FS 759.000, FS 781.500, the structure was sagging, bent and white in color. Partial frames were present on longeron L-6 on the left to L-6 on the right side.



Figure 5: Overhead at Position 8 (Approx. FS 730).

From FS 798.00 to FS 822.500, the structure was sooted. At FS 834.500, the structure was sagging and white in color from L-4 to L-12 on the left side and L-1 to L-9 on the right side. From FS 902.125 to FS 920.000, the structure was sagging and white in color from L-2 to L-5 on the right side. At FS 1020.000, the structure was sagging and a partial frame was present from L-1 to L-8 on the right side.

At FS 1040.000, the structure was sagging and a partial frame was present from L-1 to L-3 and L-9 to L-11 on the left side and L-1 to L-9 on the right side. At FS 1060.000, skin, frame and longeron deformation was present on the left side. There was partial skin burn through, and a partial

frame was present from L-1 to L-7 on the right side. From FS 1080.000 to FS1200.00, there was a partial frame from L-1 to L-7 on the left side. The frame and longeron were gone and the skin was collapsed inward from L-1 to L-7 on the right side.



Figure 6: Sagging structure located above Position 13 (Approximately FS 1174).

From FS 1080 to FS 1140, there was a partial frame present L-1 to L-14 on the right side.



Figure 7: Partial skin burn-through at FS 1060 (Position 12 right).

At the forward crown hole, from FS 1200.000 about 6 inches aft to FS 1260.000, a partial frame was present from L-1 to L-7 on the left side. On the right side, the frame, longeron, and skin were gone from L-1 to L-5.

At FS 1280.000, the frame was sagging from L-1 to L-7 on the left side and L-1 to L-7 on the right side. From FS 1300.000 to 1320.000, the frame was sagging from L-2 to L-4 on the left and L-2 to L-5 on the right. At FS 1338.213, there was a partial frame from L-1 to L-4 on the left and L-1 to

L-2 on the right. At FS 1360.000, the frame was gone and the skin was collapsed down from L-2 to L-7 on the left and L-2 to L-4 on the right.

At the aft crown hole, from FS 1380.000, the frame was gone and the skin was either missing or collapsed, from L-1 to L-13 on the left and L-1 to L-9 on the right side. At FS 1440.000, the skin was missing or collapsed and partial frames were present from L-1 to L-14 on the left and L-1 to L-4 on the right. At FS 1460.00, there was a partial frame from L-1 to L-7 on the left and L-1 to L-10 on the right. At 1480.000, the frame was sagging from L-1 to L-6 on the left. There was a partial frame on the right from L-1 to L-8. From FS 1500.000 to FS 1540.000, the skin, frames and longerons were white in color from L-2 to L-14 on the right side. There was slight deformation of the frames on the left side and a partial burn through from FS 1500.000 to FS 1520.000, L-9 to L-14 on the right side.

Upper Deck Air Distribution Ducting

Air was supplied to the main deck cargo compartment from a ventilation duct that ran down the centerline of the compartment above the ceiling liner. Supply ducts extended from the center duct to air inlet grills located on the outboard section of the ceiling liner on both the right and left sides of the interior of the fuselage. The supply ducts and inlet grills were present at approximately FS 345, 468, 550 and 670. The main ventilation duct, supply ducts, and inlet grills were all missing aft of FS 670.



Figure 8: Damaged ventilation ducting at FS 670 (Position 7).

Upper Deck Cargo Containers

All the unit load devices (ULD) were unloaded from the aircraft for examination. With the exception of Position 18, AAY¹ Lexan/Aluminum containers occupied all of the positions. Position 18 was loaded with cargo on a flat metal cargo sheet, which was wrapped with shrink-wrap.

¹ The calculated volume of the AYY container is 416.23 cubic feet (ft³) and capable of carrying up to 13,000 pounds depending on the loaded position in the aircraft.

Position 1

The container in Position 1 was located between FS 50 and 151. The container in Position 1 was normally loaded with the front curtain facing aft. It was found in this orientation on the aircraft. The container was intact. Light smoke stains and soot were present on the upper portion of the fiberglass curtain. Sooting was also present on the aluminum roof. The contents of the container appeared to be intact without noticeable fire damage.

Position 2

The container in Position 2 was located between FS 151 and 240. The container was intact with sooting on the roof. Smoke staining was also evident on the upper portion of the curtain. The contents of the container were intact without noticeable fire damage.

Position 3

The container in Position 3 was located between FS 240 and 329. The Lexan on the front wall of the container was warped at the top. The roof was intact but displayed evidence of thermal damage and sagging. The fiberglass curtain was smoke stained. The label on the container was barely legible. The contents of the container were intact without noticeable fire damage.

Position 4

The container in Position 4 was located between FS 329 and 418. This container was empty. The upper portion of the Lexan panels on the front of the container displayed sagging. The aft Lexan panel was melted at the top and sagging was present to the midline. The fiberglass curtain was melted at the top and had heat discoloration. The roof was sooted but sagging was present.

Position 5

The container in Position 5 was located between FS 418 and 507. The front Lexan panels were sagging. The roof and remaining sidewalls were heavily sooted. The roof was sagging. The fiberglass curtain was sagging and displayed black discoloration at the top and brown on the rest of the curtain. The contents of the container were intact without noticeable fire damage.

Position 6

The container in Position 6 was located between FS 507 and 596. The front panels were melted and sagged to approximately half their normal height. The back panel was melted down to half its normal height. The curtain was burned from the top and was missing material. The metallic frame of the container was intact. The contents of the container displayed smoke damage and a few packages at the rear of the container displayed some singeing.

Position 7

The container in Position 7 was located between FS596 and 685. The front panels were melted down to half their normal height. The door was burned and hanging by its support wires. The rear panel was melted past the midline. The roof was burned through. In order to remove this container from the accident aircraft, it had to be cut away from Position 8, because Position 7's rear Lexan panel was melted and stuck to Position 8. The contents of the container displayed some smoke and water damage.

Position 8

The container in Position 8 was located between FS685 and 774. The majority of the front panels were melted with large portions of material missing. The door was burned past the midline. The

front right frame post was missing. The roof was melted and the contents exhibited some burn damage.

Position 9

The container in Position 9 was located between FS 774 and 863. The left front panel and the door were destroyed. A portion of the right front panel remained intact below the midline. The majority of the roof was missing. The roof framing, from the right side of the doorpost to the left, was missing. The right corner framing was intact all the way to the floor of the container. The contents were fire damaged. In some areas of the container, the burn damage to the packages extended 12-18 inches down into the package layer.

Position 10

The container in Position 10 was located between FS 863 and 952. The fire had consumed the majority of the Lexan panels. The framing was melted past the midline and the roof was missing.

Position 11

The container in Position 11 was located between FS 952 and 1041. A portion of the right wall was intact towards the front of the container. A portion of Lexan remained on the left doorframe. A small section of Lexan remained in the lower left center of the rear panel. A partial section of the right forward wall and roof were still present. The floor was intact. The remainder of the container was destroyed.

The damage to the contents was heaviest in the aft portion across the entire width of the container. The rest of the contents sustained less damage.

Position 12

The container in Position 12 was located between FS 1041 and 1130. Portions of the Lexan remained intact in the area of the back left corner. A small portion of the roof was still present at the aft

left corner. The bottom of the container was intact.

The damage to the contents was the heaviest around the edges of the container. The center of the contents was intact to approximately 2 to 3 box heights. There was a localized heavy burn pattern in the area of the right forward corner, heading to the center of the container.



Figure 9: Crown burn-through with corresponding ULD position numbers.

Position 13

The container in Position 13 was located between FS 1130 and 1219. The lower left wall remained intact but melted from the midline down. The aft left corner had a small portion of the aluminum roof intact. Approximately $\frac{3}{4}$ of the aft midline support was intact going left to right. The

contents were damaged to approximately the depth of one box in the right forward corner. The contents in the aft left corner were intact to the midline.

Position 14

The container in Position 14 was located between FS1219 and 1306. The majority of the left Lexan panel was present and melted to the midline. The left front panel was present and melted to the midline. Instead of a curtain, this container had an aluminum door. The 2 door panels were melted down to approximately the midline.

The contents in the right aft corner were burned to approximately the depth of one box. The pattern continued forward and to the left. The pattern sloped up to the left with the aft left corner sustaining less damage than the rest of the contents.

Position 15

The container in Position 15 was located between FS 1306 and 1397. Position 15 contained large shipments of bulk printing. The container walls were mostly consumed and the roof was missing. The framing was melted past the midline.

Position 16

The container in Position 16 was located between FS 1397 and 1486. Little of the panels remained and the roof was destroyed. The contents were damaged down to approximately 1 box height across the entire length and width of the container with the center section being marginally higher.

Position 17

The container in Position 17 was located between FS 1486 and 1575. The Lexan panel was present to the midline at the rear of the container; however, it was melted and sagging. The aft midline support was intact, but was cut to remove the container from the aircraft. A portion of the roof was still

present in the aft left corner.

The contents received the heaviest damage at the sides and front of the container.

Position 18

The container in Position 18 was located between FS 1575 and 1701. The shipment at this location included boxed spools of extruded thread and hydraulic valves placed on top. The boxes were destroyed and the top layers of thread spools were missing or had been heat damaged. The hydraulic valves were found on the floor.

Items Removed from Contents

Several items were removed for further examination at the NTSB Materials Laboratory. Visual and microscopic examinations were performed, as well as disassembly of certain items. The examinations were for possible undeclared hazardous materials, power sources, and identification of damaged items. Table 1 lists the items retained for examination.

Table 1: Evidence Retained by Cargo/Fire Group

NTSB Lab. Number	Container Location	Description	Condition
1	16	Laptop	Outer computer case sooted and melted. Batteries intact
2	17	Laptop	Outer computer case sooted and melted. Batteries intact
3	13	Laptop	Outer computer case sooted and melted. 2 batteries still present
4	14	Lithium batteries	Intact. White substance found on caps.
5	13	Lithium batteries	Intact. White substance found on caps

NTSB Lab. Number	Container Location	Description	Condition
6	16	Lithium battery pack (15 cells)	Intact
7	12	Laptop with carrying case	Carrying case mostly missing. Outer computer case sooted and melted. 5 batteries intact. 6 th battery found without casing (copper winding remaining).
8	11	Scanner with unassociated metal piece attached	Scanner sooted and melted. Unassociated metal piece melted into scanner case.
9	10	Laptop	Outer case intact with exception of melting to right corner. Batteries intact.
10	10	Laptop	Top of computer case sooted and melted. Batteries intact with white substance found on caps.
11	10	Unidentified electronic device with unassociated wiring melted to it/No power supply	Device had sooting and scorching with material missing from the interior and exterior. Unassociated wiring missing insulation.
12	11	Uninterrupted power supply	Outer case melted in left side. Battery inside unit intact and undamaged.
13	12	Laptop with case	Carrying case mostly burned away. Computer case sooted and melted. Batteries not found.
14	Found on right wing	Unidentified electronic device/ No power supply	Device had sooting and scorching with material missing.
15	11	Unidentified electronic device/ No power supply	Device had sooting and scorching with material missing.

NTSB Lab. Number	Container Location	Description	Condition
16	11	Computer component	Component had sooting and scorching with material missing. Circuit boards were brittle with resin burned out.
17	11	Unidentified electronic device/ No power supply	Device had sooting and scorching with material missing.
18 A-E	9	5 credit card scanners	All scanners cases melted with various degrees of sooting with material missing.
19	12	Lithium batteries	Batteries intact. Evidence of bulging and white substance on caps.
20	9	Unidentified electronic device/ No power supply	Device had sooting and scorching with material missing.
21	9	Unidentified electronic device/ No power supply	Device had sooting and scorching with material missing.
22	8	Credit card scanner	Scanner heavily melted with material missing.
23	10	DVR	Outer case burned away.
24	10	Laptop	Outer computer case had sooting and scorching with material missing. 4 batteries still present
25	10	Hand scanner with NI-MH batteries	Outer casing melted. Batteries intact.
26	10	2 loose lithium batteries	Intact with possible aluminum extrusions through the caps. Slight bulging.
27	12	Lithium battery	Cap missing. Copper winding extruding through top of cell.
28	12	Unidentified electronic device w/wiring-no power supply	Wiring has all the insulation missing and has no sign of arcing. Device had a missing outer cover and had melting to inner aluminum casing.

NTSB Lab. Number	Container Location	Description	Condition
29	12	Lithium-ion batteries	Intact. Slight bulging.
30	13	Lithium-ion batteries	Intact.
31	13	6 watch-type batteries	Intact.
32	13	Credit card scanner	Outer case heavily melted and scorched.
33	11	Laptop with carrying case	Carrying case mostly burned away. Computer case heavily melted and scorched. 4 batteries found intact. Copper windings from another battery found.
34	11	Lithium-ion batteries	1 battery intact with slight bulge. 1 battery was missing the cap with copper windings extruding from top.

Upper Cargo Compartment Liners

Position 1

At Position 1, the ceiling liner was sooted. The sidewalls were relatively clean and the right sidewall was composed of aluminum panels.

Position 2

At Position 2, the ceiling liner was sooted. The right sidewall was composed of aluminum panels. Approximately 1/3 of the tops of both sidewalls were sooted.

Position 3

At Position 3, the ceiling and approximately 1/3 of the top of sidewalls were sooted. The forward 3/4 of right sidewall was composed of aluminum panels and the aft 1/4 was fiberglass.

Position 4

At Position 4, the ceiling and the top 1/2 of the sidewalls were sooted.

Position 5

At Position 5, the ceiling and the top half of both sidewalls were sooted. On the aft right side of ceiling liner, the resin was burned.

Position 6

At Position 6, the right side of the ceiling and the sidewall was sooted half way down. The ceiling and right upper sidewall displayed evidence of burned resin. The resin was burned on approximately on 1/4 of the upper portion of the left sidewall was also burned.

Position 7

At Position 7, the left and right sidewalls were sooted on the upper half. The resin was burned on approximately 1/4 of the upper sidewalls on both the left and right side. The ceiling liner was hanging down on aft end with visible resin burns present.

Position 8

The ceiling liner at Position 8 was missing. The upper half of the left sidewall was missing. The bottom half of the right sidewall exhibited discoloration. The upper 1/3 of right sidewall had burned resin. The right lower sidewall was not damaged.

Position 9

At Position 9, the ceiling liner and the upper half of the left sidewall was missing. The upper 1/4 of the right sidewall were missing. The remaining lower left section of the sidewall had burned resin. The resin had also been burned on the remaining right sidewall.

Position 10

At Position 10, the ceiling, left sidewall, and upper 1/2 of right sidewall were missing. The remaining lower right sidewall had burned resin and exhibited discoloration.

Position 11

At Position 11, the ceiling and upper $\frac{3}{4}$ of the left sidewall were missing. The lower $\frac{1}{4}$ of the left sidewall was sooted and portions of the resin were burned. The forward portion of the right sidewall exhibited burning of the resin and the upper aft section was missing.

Position 12

At Position 12, the right sidewall, the upper $\frac{1}{2}$ of the left sidewall, and the ceiling were missing. The upper portion of the remaining right sidewall exhibited burned resin and the lower section of the right sidewall exhibited discoloration.

Position 13

At Position 13, the upper half of the left sidewall, the ceiling, and the upper $\frac{3}{4}$ of the right sidewall were missing. The upper $\frac{1}{4}$ of remaining left sidewall had burned resin and the lower $\frac{1}{4}$ was discolored.

Position 14

At Position 14, the upper half of the left sidewall, the ceiling, and the upper $\frac{3}{4}$ of the right sidewall were missing. The upper $\frac{1}{4}$ of the remaining lower section of the left sidewall had the resin burned. The lower $\frac{1}{4}$ was discolored. The lower $\frac{1}{4}$ of the right sidewall had the resin burned out of the liner leaving white fiberglass cloth in sections.

Position 15

At Position 15, the upper half of the left sidewall, the ceiling liner, and the upper $\frac{3}{4}$ of the right sidewall were missing. The upper quarter of the remaining lower section of left sidewall resin was burned and the remaining lower section was discolored. The lower $\frac{1}{4}$ of the right sidewall had the resin burned and baked out, leaving white fiberglass cloth in sections.

Position 16

At Position 16, the left sidewall, ceiling, and upper half of the right sidewall was missing. The lower half of the right sidewall displayed resin burning and discoloration.

Position 17

At Position 17, the right sidewall and ceiling sections were missing. The upper forward section of the left sidewall was missing. The remaining upper sections of the left sidewall displayed burned resin and the lower section exhibited discoloration.



Figure 9: Cargo liner at Position 18.

Position 18

At Position 18 the ceiling liner was missing. The upper ¼ of the left sidewall exhibited burned resin and the lower left sidewall was sooted. The resin in the upper ¼ of the right sidewall was burned, and the lower right sidewall was sooted.

Lower Cargo Compartments.

There were 4 lower cargo compartments on the airplane. The compartments were originally designated as class D compartments that did not require fire detection or suppression systems. The compartments were converted to class E compartments due to new regulations. Secureairplane wireless detectors were added to the compartments to comply with the requirements for class E compartments. Suppression systems are not required for class E compartments. No evidence of soot or fire damage was observed in any of the lower compartments.

Pit #31

Pit #31 was approximately 70% full by volume with the majority of the items in cardboard boxes. There was no visible smoke or heat damage and no smell of burnt materials.

In this pit, various locations behind the liner were examined to determine if there were any signs of fire propagation. Dirt, lint, anti corrosion agent residue, and "staining" were found but with no discernable patterns were evident.



Figure 10: Check area Pit #31.



Figure 11: Check area in Pit #31 looking towards Pit #32.

Pit #32

This cargo hold was empty, with the exception of a few items: One green document box, a Parts-for-Maintenance (PFM) crate and long cardboard tubular containers. There were no signs of smoke or thermal damage.

Various locations of the lower sidewall were examined with the liner removed to expose the space behind it. A section of liner was also removed from the ceiling to examine the area behind it. Upon removal of the liners, staining was found. No fire debris was found in the cheek areas examined and there were no smoke patterns identified. The only debris found was in the form of lint and grime. All the surfaces and components behind the liners were also coated with residue from anti-corrosion agent.



Figure 12: Cheek area in Pit #32.



Figure 13: Ceiling in Pit #32.



Figure 14: Check area in Pit #32 looking towards Pit #33.

Pit #33

Pit #33 was approximately 50% full of various sized items in cardboard boxes. No sign of smoke or thermal damage was present on the cargo liners. The cargo liner in the cheek area was removed to expose and inspect the structure behind. The structure behind the cargo liner was sooted and small pieces of debris as a result of cargo removal operations from the main cargo hold were found therein; however, it was discovered that solidified aluminum and Lexan drippings existed, which had fallen in from above while still hot and had adhered to the structural components. Examination of the soot deposits revealed heavier sooting towards the forward end of the compartment, with the sooting getting progressively lighter towards the aft portion of the compartment.

During the initial examination, the gill liners in the cheek area of Pit #33 had been removed. The removal of the gill liners had exposed extensive staining of the structural/mechanical components behind them and also the back face of the liner itself. There were also small pieces of fire debris found in the cheek areas behind the liners.



Figure 15: Pit #33 looking forward.



Figure 16: Pit #33 looking aft.

The entire underside of the ceiling was examined and it was found that there was a soot-like stain on all surfaces behind the liners, but with no discernable flow patterns. All the surfaces and components behind the liners were coated with residue from an anti-corrosion agent.



Figure 17: Ceiling in Pit #33

Pit #34

This cargo hold was completely empty. There were no sign of smoke or thermal damage.